IN THE MATTER OF
Patent Application of
HONDA MOTOR CO., LTD.

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Signed this 24th day of April, 2009

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[Document Name] Patent Application

[Reference Number] PCH18029HM

[Date of Submission] March 2, 2004

[To] The Commissioner of the Patent Office

[International Patent Classification] F16D 3/20

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[Indication of Fees]
[Prepayment Register Number] 001834
[Amount of Payment] 21000

[List of the Attached Documents]
[Document Name] Claims 1
[Document Name] Specification 1
[Document Name] Drawings 1
[Document Name] Abstract 1
[General Power of Attorney Number] 9711295
[General Power of Attorney Number] 0206309

[DOCUMENT NAME] Claims

[Claim 1]

A tripod constant-velocity joint having a tubular outer member having a plurality of axially extending guide grooves defined in an inner circumferential surface thereof and spaced at predetermined intervals, said outer member being connected to one transmission shaft, and an inner member inserted in an open internal space of said outer member and connected to another transmission shaft, wherein

said inner member comprises:

a plurality of trunnions projecting into said guide grooves;

a ring-shaped roller held in contact with each of said guide grooves and fitted over each of said trunnions; and

a plurality of rolling elements rollingly interposed between each of said trunnions and said roller;

wherein a flange is disposed on an end of said roller in an axial direction of an inside-diameter surface thereof and projects radially inwardly, and a retaining member is mounted on another end of said roller in an annular groove for retaining said rolling elements;

said retaining member being disposed near a proximal end of said trunnion in an axial direction thereof.

[Claim 2]

A constant-velocity joint according to claim 1, wherein

an axial thickness of a portion of said roller with said retaining member mounted thereon on one side of a central axis C extending diametrically across said roller is greater than an axial thickness of another portion of said roller with said flange disposed thereon on the other side of the central axis C, said central line C being in agreement with a center of said rolling elements which divides an axial length thereof into two equal dimensions.

[Claim 3]

A constant-velocity joint according to claim 1 or 2, wherein said retaining member comprises at least a circlip.

[DOCUMENT NAME] Specification

[TITLE OF THE INVENTION] CONSTANT VELOCITY JOINT

[TECHNICAL FIELD]

[0001]

The present invention relates to a constant-velocity joint for connecting a transmission shaft to another transmission shaft in the drive power transmitting mechanism of an automobile, for example.

[BACKGROUND ART]

[0002]

Heretofore, the drive power transmitting mechanisms of automobiles employ a constant-velocity joint for connecting a transmission shaft to another transmission shaft to transmit rotational power to axles.

[0003]

A conventional constant-velocity joint of this type is shown in FIG. 5 (Patent Document 1). As shown in FIG. 5, the constant-velocity joint has a roller mechanism 6 including a retaining ring 4 retained by a circumferential groove 3 and mounted on an axial end of a cylindrical inner circumferential surface 2 of a roller 1, and a retaining flange 5 disposed on the other axial end of the cylindrical inner circumferential surface 2 and integrally formed with the roller 1.

[0004]

A plurality of needle rollers 7 are mounted on the cylindrical inner circumferential surface 2, and held in

place by a support ring 9 that is fitted over the outer circumferential surface of a trunnion 8.

[0005]

With the roller mechanism 6 disclosed in Patent Document 1, the retaining ring 4 is disposed at a distal end 8a of the trunnion 8, and the retaining flange 5 is disposed at a proximal end 8b of the trunnion 8.

[0006]

[Patent Document 1] Japanese Laid-Open Patent Publication No. 2001-208090

[DISCLOSURE OF THE INVENTION]

[TASK TO BE SOLVED BY THE INVENTION]

[0007]

If the retaining ring 4 of the roller mechanism 6 disclosed in Patent Document 1 is dislodged from the circumferential groove 3 for some reasons, then the needle rollers 7 placed between the cylindrical inner circumferential surface 2 of the roller 1 and the support ring 9 will be ejected out of the roller 1, tending to impair a rotational drive power transmitting function of the constant-velocity joint.

[0008]

In view of the above, an object of the present invention is to provide a constant-velocity joint which is prevented from impairing a rotational drive power transmitting function thereof even if a retaining member is dislodged from a roller.

[SOLUTION FOR THE TASK]

[0009]

To achieve the above object, the present invention is to provide a tripod constant-velocity joint having a tubular outer member having a plurality of axially extending guide grooves defined in an inner circumferential surface thereof and spaced at predetermined intervals, the outer member being connected to one transmission shaft, and an inner member inserted in an open internal space of the outer member and connected to another transmission shaft, wherein

the inner member comprises:

a plurality of trunnions projecting into the guide grooves;

a ring-shaped roller held in contact with each of the guide grooves and fitted over each of the trunnions; and

a plurality of rolling elements rollingly interposed between each of the trunnions and the roller;

wherein a flange is disposed on an end of the roller in an axial direction of an inside-diameter surface thereof and projects radially inwardly, and a retaining member is mounted on another end of the roller in an annular groove for retaining the rolling elements;

the retaining member being disposed near a proximal end of the trunnion in an axial direction thereof.

[0010]

With the above arrangement, an axial thickness ($L + \Delta A$) of a portion of the roller with the retaining member mounted

thereon on one side of a central axis C extending diametrically across the roller may be greater than an axial thickness (L) of another portion of the roller with the flange disposed thereon on the other side of the central axis C, the central line C being in agreement with a center of the rolling elements (B1 = B2) which divides an axial length thereof into two equal dimensions.

[0011]

The retaining member may comprise at least a circlip.

[0012]

According to the present invention, the retaining member is mounted on the proximal end of the trunnion in the axial direction thereof. Even if the retaining member is dislodged from the annular groove for some reasons, since the retaining member is not mounted on the distal end of the trunnion, the rolling elements placed on the inside-diameter surface of the roller are retained by the flange of the roller under centrifugal forces generated by the rotation of the constant-velocity joint, and hence are prevented from being ejected from the inside-diameter surface of the roller.

[EFFECT OF THE INVENTION]

[0013]

The following effects can be obtained according to the present invention.

[0014]

Even if the retaining member is dislodged from the

annular groove for some reasons, the rolling elements placed on the inside-diameter surface of the roller are retained by the flange of the roller under centrifugal forces generated by the rotation of the constant-velocity joint, and hence are prevented from being ejected from the inside-diameter surface of the roller. As a consequence, the constant-velocity joint has its rotational drive power transmitting function prevented from being impaired.

[BEST MODE FOR CARRYING OUT THE INVENTION]

[0015]

Preferred embodiments of the constant velocity joint of the present invention will be explained below referring to the attached drawings.

[0016]

FIG. 1 is a fragmentary vertical cross-sectional view of a constant-velocity joint 10 according to an embodiment of the present invention. The constant-velocity joint 10 basically comprises a tubular outer cup (outer member) 12 connected to an end of a first shaft, not shown, and having an opening, and an inner member 16 fixed to a second shaft 14 and housed in an hollow space of the outer cup 12.

[0017]

The outer cup 12 has three guide grooves 18a to 18c defined in the internal space thereof which are angularly spaced at 120-degree intervals around the axis, as shown in FIG. 1 (the guide grooves 18b and 18c are not shown). Each of the guide grooves 18a to 18c comprises a ceiling 20

having a curved cross section and a pair of sliding faces 22a, 22b disposed on both sides of the ceiling 20 in confronting relation to each other and having an arcuate cross section.

[0018]

A ring-shaped spider 24 is fitted over the second shaft 14. The spider 24 has three trunnions 26a to 26c integrally formed with the outer circumferential surface thereof around the shaft center at an interval of 120 degrees and projecting into the respective guide grooves 18a to 18c (the trunnions 26b, 26c are not shown).

[0019]

A ring-shaped roller 30 is fitted over the outer circumference of the trunnions 26a to 26c with a plurality of rolling elements 28 interposed therebetween. The rolling elements 28 may be roller bearings including needles, rollers, etc.

[0020]

As shown in FIG. 2, the inner circumferential surface of the roller 30 comprises an arcuate face 32 shaped complementarily to the cross-sectional shapes of the sliding faces 40a, 40b, a first annular slanted face 36a extending continuously from the arcuate face 32 toward the first upper surface 34, and a second annular slanted face 58b extending continuously from the arcuate face 32 toward the second lower surface 38.

[0021]

The roller 30 has an inside-diameter surface 40 on its inner circumference thereof which has a constant diameter and functions as a rolling surface for the rolling elements 28. The roller 30 has an annular flange 42 integrally formed therewith which projects a predetermined length radially inwardly at a position near the distal end 41 of the trunnion 26a (26b, 26c) above the inside-diameter surface 40.

[0022]

A circlip (retaining member) 46 is mounted in an annular groove 44 near the proximal end 43 of the trunnion 26a (26b, 26c) beneath the inside-diameter surface 40 opposite to the flange 42. The rolling elements 28 mounted on the inside-diameter surface 40 of the roller 30 are vertically held in position by the flange 42 and the circlip 46.

[0023]

The circlip 46 may be replaced with a washer, not shown, press-fitted in an annular recess in the roller 30. The retaining member is not limited to the circlip or the washer, but may be a clip, a press-fitted member, a spring lock washer, a spring washer, a washer, a snap ring, a retaining ring, a spring washer, a grip snap ring, a ring, or the like.

[0024]

With the tripod constant-velocity joint 10, the trunnion 26a (26b, 26c) and the roller 30 slide relatively

against each other in the axial directions of the trunnion 26a (26b, 26c). Therefore, it is necessary to provide retaining members such as the circlip 46, etc. on the both ends of the inside-diameter surface 40 of the roller 30 for limiting the axial displacement of the rolling elements 28.

[0025]

The relative sliding movement refers to sliding movement of the trunnion 26a (26b, 26c) in its axial directions with respect to the roller 30 or sliding movement of the roller 30 in its axial directions with respect to the trunnion 26a (26b, 26c).

[0026]

[0027]

The rolling elements 28 are juxtaposed substantially parallel to each other circumferentially on the inside-diameter surface 40 of the roller 30. The rolling elements 28 are retained against separation or dislodgment from the inside-diameter surface 40 by the flange 42 and the circlip 46 which are disposed on both ends of the inside-diameter surface 40. It is assumed that the needle bewaring rollers 46 disposed along the inside-diameter surface 40 of the roller 30 have substantially the same diameter and substantially the same shape. The trunnion 26a (26b, 26c) has a cylindrical portion 45 having a constant outside diameter.

[0028]

As shown in FIG. 2, if a central line C is drawn

diametrically across the roller 30 dividing the arcuate face 56 contacting the guide groove 18a (18b, 18c) of the outer cup 12 into two equal upper and lower sections, then the length (thickness) from the central line C to an upper first surface 234 is represented by L, the length (thickness) from the central line C to a lower second surface 238 by (L + ΔA), and the overall axial thickness of the roller 30 by (2L + ΔA).

[0029]

Specifically, the side of the roller 30 where the circlip 46 for preventing the rolling elements 28 from being dislodged is provided is thicker than the side of the roller 30 where the flange 42 is provided, by the axial dimension ΔA for supporting the circlip 46. Therefore, the flange 42 side and the circlip 46 side have different thicknesses along the axial directions on both sides of the central line C extending diametrically across the roller 30.

[0030]

The central line C extending diametrically across the roller 30 divides the total axial length of the rolling elements 28 into two equal dimensions (B1 = B2). The center of the rolling elements 28 which divides the axial length into two equal dimensions and the central line C of the roller 30 are in agreement with each other.

[0031]

The constant-velocity joint 30 according to the embodiment of the present invention is basically constructed

as described above. A process of assembling the constant-velocity joint 30 and operation and advantages of the constant-velocity joint 30 will be described below.

[0032]

Operation of the constant-velocity joint 30 will be described below.

[0033]

When the first shaft (not shown) rotates, torque is transmitted to the inner member 16 via the outer cup 12, and then the second shaft 14 is rotated through the trunnions 26a to 26c.

[0034]

That is, torque of the outer cup 12 is transmitted to the trunnion 26a (26b, 26c) via a plurality of rolling elements 28 retained in the roller 30 and the inside-diameter surface 40 of the roller 30 face-contacting with the sliding faces 22a, 22b of the guide groove 18a (18b, 18c), so that the second shaft 14 engaging with the trunnion 26a (26b, 26c) rotates.

[0035]

According to the embodiment, the thicker portion of the roller 30 wherein the circlip 46 is mounted on one side of the central line C of the roller 30 is disposed closely to the proximal end 43 of the trunnion 26a (26b, 26c), and the roller 30 is placed in position for sliding movement along the guide groove 18a (18b, 18c) of the outer cup 12.

[0036]

According to the embodiment, therefore, even if the circlip 46 is dislodged from the annular groove 44 for some reasons, since the circlip 46 is mounted on the proximal end 43 of the trunnion 26a (26b, 26c), rather than on the distal end 41 thereof, the needle bearing rollers 46 placed on the inside-diameter surface 40 of the roller 30 are retained by the flange 42 of the roller 30 under centrifugal forces generated by the rotation of the constant-velocity joint 10, and hence are prevented from being ejected from the inside-diameter surface 40 of the roller 30. Therefore, the constant-velocity joint 10 has its rotational drive power transmitting function prevented from being impaired.

[0037]

As shown in FIG. 3, according to a first comparative example, the roller 30 is assembled such that the flange 42 and the circlip 46 are disposed upside down unlike the above embodiment such that the circlip 46 is positioned near the distal end 41 of the trunnion 26a (26b, 26c) and the flange 242 is positioned near the proximal end 43 of the trunnion 44. With the arrangement of the first comparative example, the roller 30 and the ceiling 20 of the guide groove 18a contact each other, reducing the operating angle that is formed as angle at which the first shaft and the second shaft 14 cross each other.

[0038]

According to the embodiment, however, the flange 42 side on one side of the central line C extending

diametrically across the roller 30 is thinner to provide a sufficient distance by which the upper first surface 34 of the roller 30 and the ceiling 20 of the guide groove 18a (18b, 18c) are spaced from each other. Therefore, the operating angle of the embodiment is greater than the operating angle of the first comparative example.

[0039]

As shown in FIG. 4, according to a second comparative example, the axial length M from a central line C extending diametrically across a roller 30 to an upper first surface 34 of the roller 30 and the axial length M from the central line C to a lower second surface 38 of the roller 30 are identical to each other, and the length from the central line C to an axial end of rolling elements 60 and the length from the central line C to the other axial end of the rolling elements 60 are different from each other ($D1 \neq D2$). The central line C of the roller 30 which divides the arcuate face 32 into two equal sections and the center of the rolling elements 60 which divides the axial length thereof into two equal dimensions are not in agreement with each other. When a load torque is transmitted from the outer cup 12 through the roller 30 and the rolling elements 60 to the trunnion 26a (26b, 26c), because the axial length of the rolling elements 60 is not equally distributed on both sides of the central line C of the roller 30, unequal loads are applied to the trunnion 26a (26b, 26c) and the rolling elements 60, possibly adversely affecting the

durability of the trunnion 26a (26b, 26c).

[0040]

According to the second comparative example, furthermore, if the axial length of the rolling elements 60 is shortened to bring the center of the rolling elements 60which divides the axial length thereof into two equal dimensions into agreement with the central line C of the roller 30, then since the length along which the needle rolling elements 60contact the outer circumferential surface of the trunnion 26a (26b, 26c) is reduced, the pressure on the contacting surfaces increases. As a result, an excessive load is imposed on the proximal end 43 of the trunnion 26a (26b, 26c), tending to reduce the durability of the trunnion 26a (26b, 26c).

[0041]

According to the eighth embodiment, however, although the flange 42 side and the circlip 46 side of the central line C of the roller 30 are of vertically asymmetrical shapes with different thicknesses, the central line C of the roller 30 and the center of the rolling elements 28 which divides the axial length thereof into two equal dimensions (B1 = B2) are in agreement with each other, so that the rolling elements 28 have a sufficient axial length for contact with the outer circumferential surface of the trunnion 26a (26b, 26c), preventing the durability of the trunnion 26a (26b, 26c) from being reduced.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0042]

[FIG. 1]

FIG. 1 is a fragmentary vertical cross-sectional view of a constant-velocity joint according to an embodiment of the present invention.

[FIG. 2]

FIG. 2 is a partial enlarged vertical cross-sectional view showing a roller of the constant-velocity joint shown in FIG. 1.

[FIG. 3]

FIG. 3 is a perspective view, partly in cross section, of a constant-velocity joint according to a first comparative example.

[FIG. 4]

FIG. 4 is an enlarged fragmentary vertical cross-sectional view of a roller of a constant-velocity joint according to a second comparative example.

[FIG. 5]

FIG. 5 is an enlarged vertical cross-sectional view, partly omitted from illustration, of a conventional constant-velocity joint, the view being taken along a direction perpendicular to the axis of the constant-velocity joint.

[DESCRIPTION OF REFERENCE NUMERALS]

[0043]

10: constant-velocity joint, 12: outer member,

16: inner member, 18a to 18c: guide groove,

26a to 26c: trunnion, 28: rolling element,

30: roller, 40: inside-diameter surface, 41: distal end,

42: flange, 43: proximal end, 44: annular groove,

46: circlip

FIG. 1

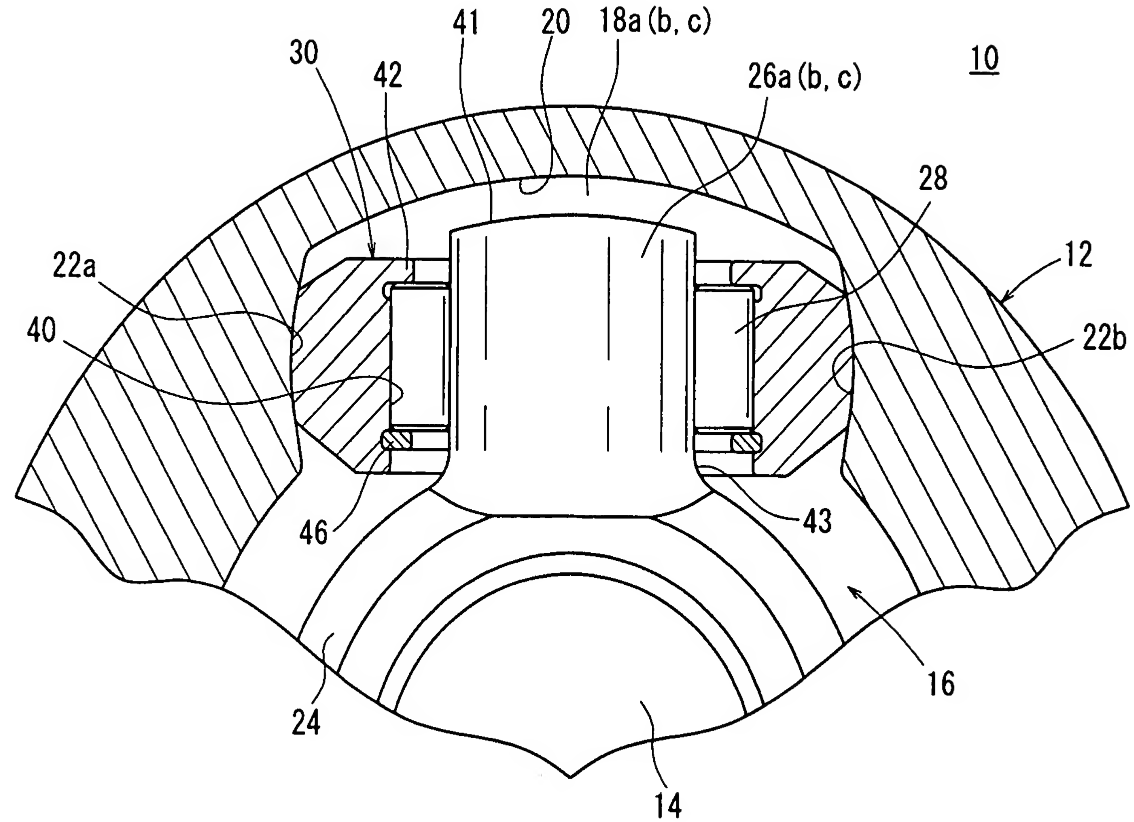
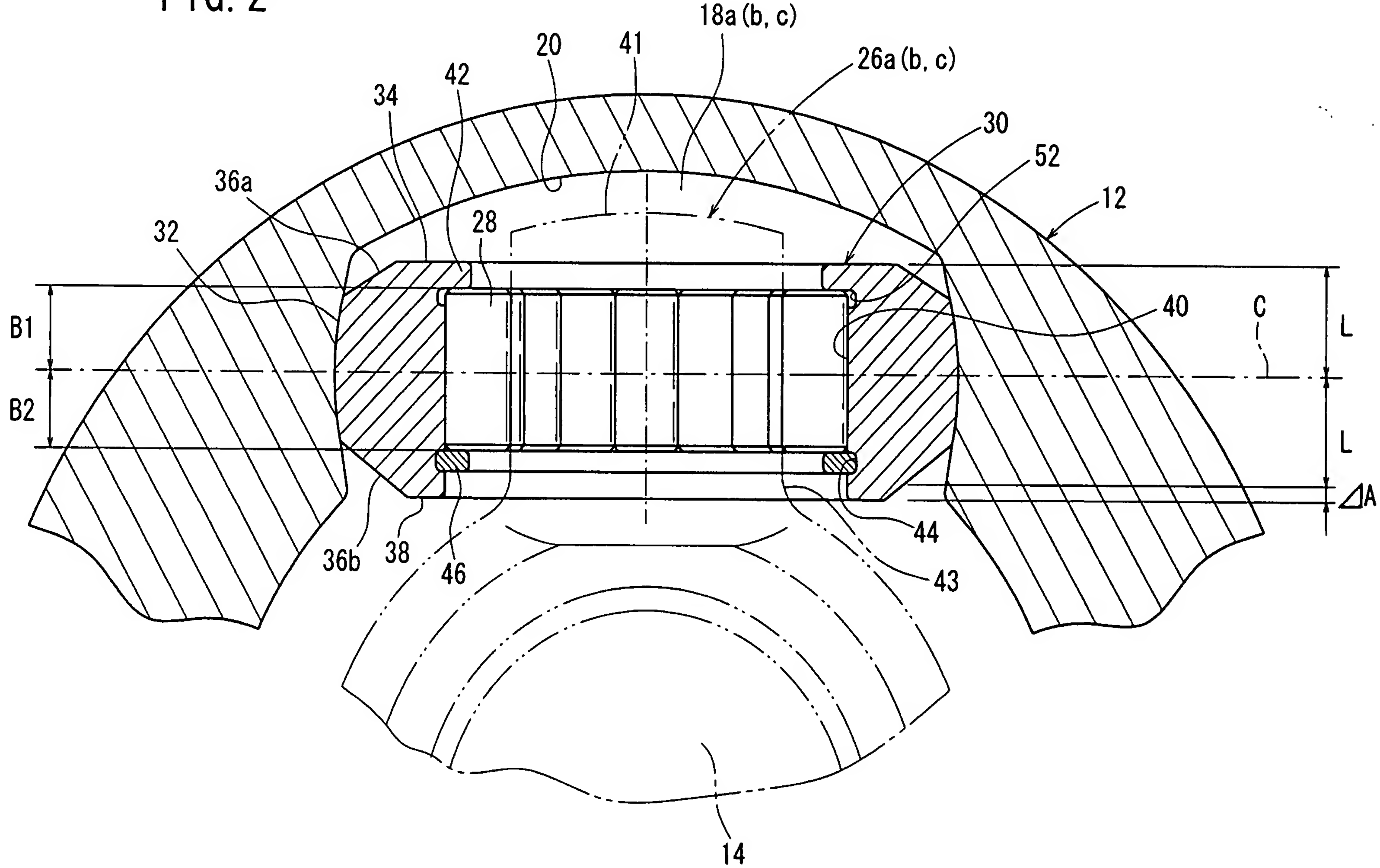


FIG. 2



18a (b, c)
26a (b, c)
20
41
42
34
36a
32
28
30
52
12
40
C
L
L
⊿A
B1
B2
36b
38
46
44
43
14

FIG. 3

(1ST COMPARATIVE EXAMPLE)

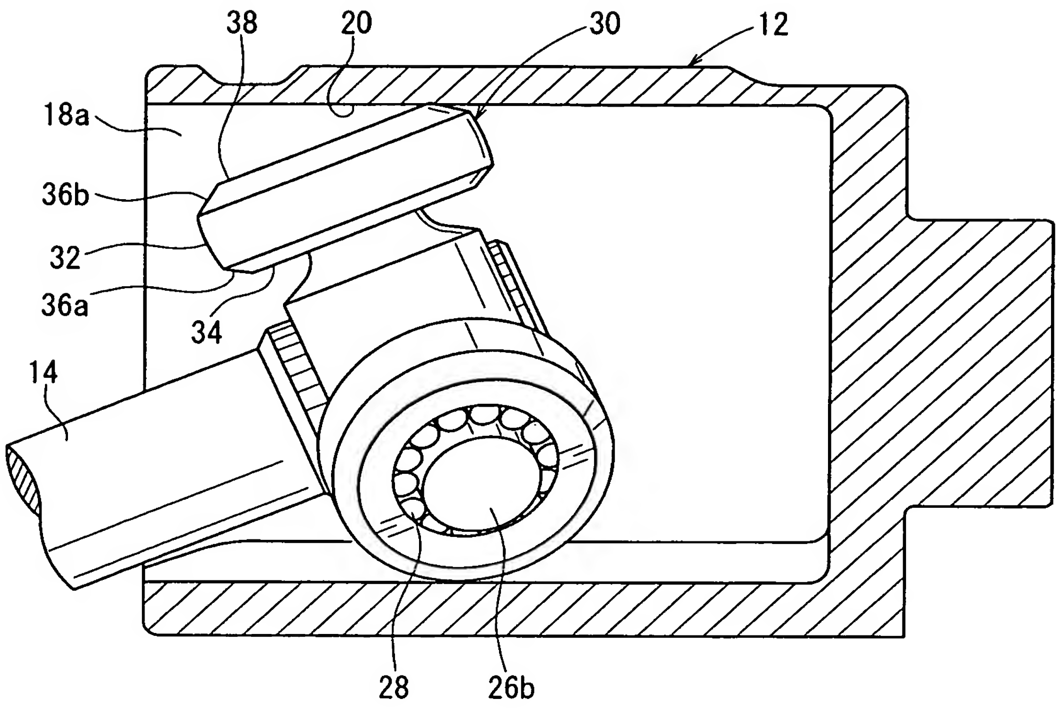


FIG. 4 (2ND COMPARATIVE EXAMPLE)

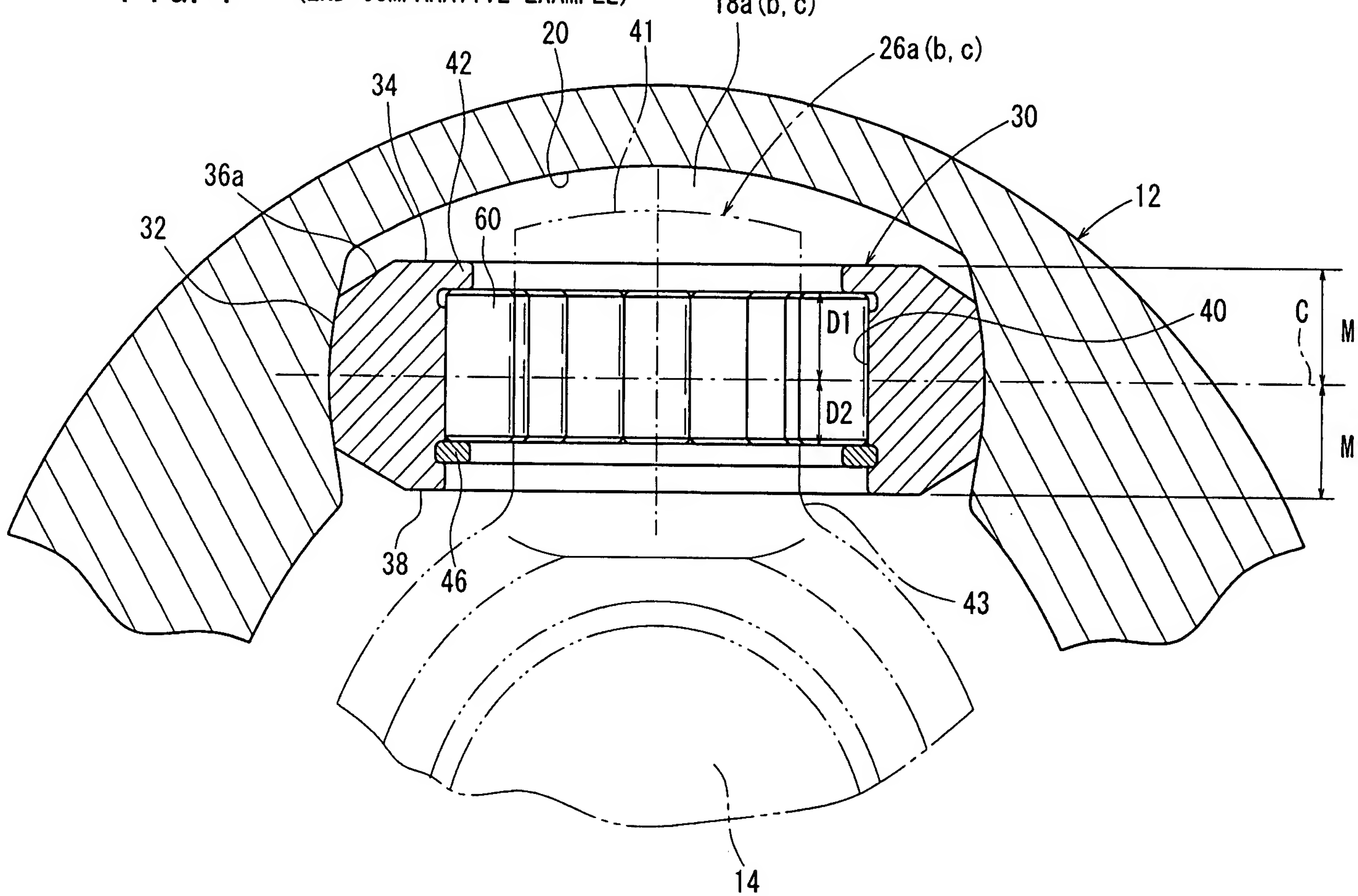
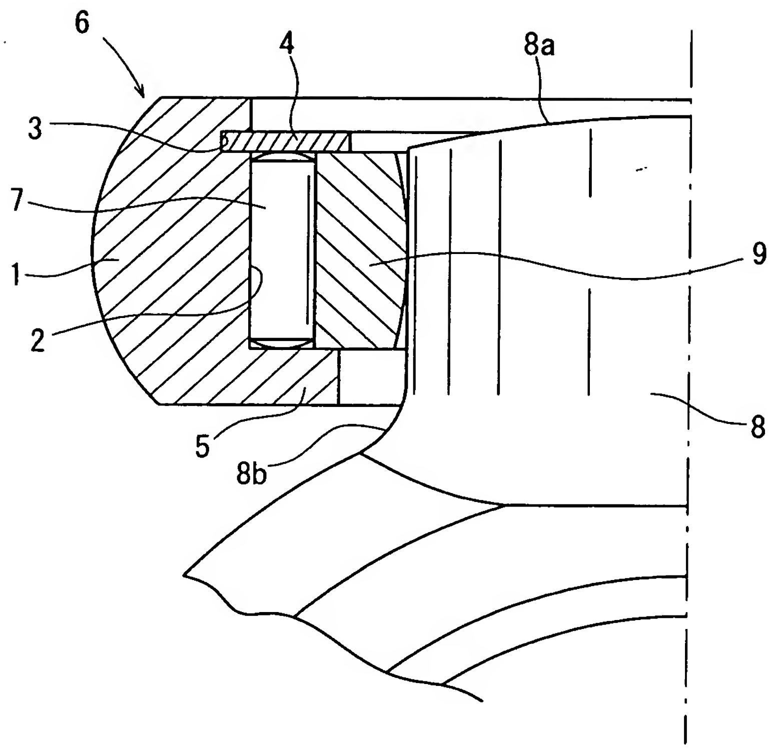


FIG. 5



[DOCUMENT NAME] Abstract

[ABSTRACT]

[TASK] To provide a constant-velocity joint which is prevented from impairing a rotational drive power transmitting function thereof even if a retaining member is dislodged from a roller.

[SOLUTION] A circlip 46 for preventing a rolling element 28 from being dislodged is mounted closely to the proximal end 43 of the trunnion 26a (26b, 26c) at a position where the thickness of a roller is set thicker by ΔA, when compared with the side of a flange 42, for supporting the circlip 46. A central axis C of the roller 30 is in agreement with a center of the rolling elements (B1 = B2) which divides an axial length thereof into two equal dimensions.

[SELECTED FIGURE] FIG. 2